Iowa Seat Belt Use Survey
2021 Data Collection
Methodology Report

September 29, 2021

Prepared by
MB Allen, JR Fox, E Berg
Iowa State University
Center for Survey Statistics & Methodology

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

AMES, IOWA

Introduction

In an effort to achieve greater consistency and comparability in state-wide seat belt use reporting, the National Highway Traffic Safety Administration (NHTSA) issued new requirements in 2011 for observing and reporting future seat belt use. The requirements included the involvement of a qualified statistician in the sampling and weighting portions of the process as well as a variety of operational details.

The Iowa Governor's Traffic Safety Bureau contracted with Iowa State University's Center for Survey Statistics and Methodology (CSSM) (then Survey & Behavioral Research Services) in 2011 to develop the study design and data collection plan for the State of Iowa's annual survey that would meet the new requirements of the NHTSA. A seat belt survey plan for Iowa was developed by CSSM with statistical expertise provided by Zhengyuan Zhu, Ph.D., Professor of Statistics at Iowa State University and Director of the Center for Survey Statistics and Methodology. The plan was approved by NHTSA on March 19, 2012 and implemented for five years, in the summers of 2012-2016.

As required by NHTSA, the Iowa plan was revised in the fall of 2016. Dr. Emily Berg, Assistant Professor of Statistics at Iowa State University, followed the protocol of the original approved plan and redrew the counties and road segments to be used for future data collection. After examining current county data relating to fatalities, vehicle miles traveled, and other relevant factors, she sampled 15 counties (as in 2012) but increased the number of sampled road segments from 75 to 84. Six of the 15 counties used in 2012-2016 were also selected for the new plan; nine counties were different. As in Iowa's 2012 plan, five road segments were sampled from each county; however, the new plan increased the number of sampled road segments from Polk County to 14 because of its significantly higher traffic levels. The revised plan was submitted in December of 2016 and approved in March of 2017. This plan was implemented by CSSM in 2017, 2018, 2019, 2020 and again in 2021.

2021 Data Collection

The Iowa GTSB has contracted with CSSM on an annual basis to conduct the seat belt use data collection since 2012. The primary contact at the Iowa GTSB in 2021 is Cinnamon Weigel, Occupant Protection Coordinator. The primary contact at CSSM is Mallary Allen, PhD, Survey Unit Director. The CSSM Seat Belt Survey Project Manager is Jody Fox. The CSSM statistician for the 2019 Seat Belt Survey is Emily Berg, PhD, Assistant Professor of Statistics at Iowa State University. This report describes the data collection process for obtaining 2021 seat belt use data as stipulated by the approved study design. It also includes tables with overall results showing seat belt use in Iowa.

Preparation

Preparation for the 2021 seat belt use data collection involved several components, including: verification of the usability of the sampled sites, revision of materials for Data Collectors, and notification of appropriate local personnel prior to data collection.

Site Verification.

The Iowa Seat Belt Survey Plan includes 84 road segments or sites sampled for annual observation, with 5 sites in each of 14 sampled counties and 14 sites in Polk County. The sites are identified by MSLINK numbers. CSSM has worked with staff from *InTrans*, the Iowa State University Institute of Transportation, to obtain data and photographic resources that allow staff to examine each site remotely for accessibility, safety, and practicality. The CSSM Project Manager re-examined the 84 sites for any changes since 2019 and checked with the Department of Transportation and other online sources for scheduled construction that could impact traffic patterns. All 84 sites were verified as safe and useable for 2021.

Materials Preparation.

After the 84 sites were finalized, CSSM staff used online maps and Google Earth as well as notes from 2017, 2018, 2019 and 2020 observers to identify and recommend observation points that would be safe and still provide the visibility necessary to observe seat belt use. CSSM staff updated existing maps for Data Collectors to use as references when traveling to sites. Google Earth and Google maps served as effective resources.
Equipment was prepared for use by Data Collectors, including vests, hats, warning lights, "Survey Crew" signs, stop watches, and clickers. Data collection forms were printed. Data Collection schedules were prepared for each Data Collector and administrative procedures were documented.

Figure 1.

> **Seat Belt Data Collectors**
> **2021 Training Agenda**
>
> Iowa Observational Survey of Seat Belt Use
> Governor's Traffic Safety Bureau/Iowa State University
>
> Training Agenda
> Tuesday, June 8, 2021
>
> | 9am | Arrive, Introductions, Overview |
> | 10am | Safety |
> | 11am | Training Manual, Google Earth |
> | 12pm | Lunch |
> | 1pm | Neely: Expense Reimbursement, Time Sheets, etc |
> | 2pm | Assignments |
> | 3-ish | break |
> | 315pm | Equipment and supplies |
> | 330pm | Street Side Practice; Google Earth |

Notification.

Prior to the data collection process, the GTSB representative notified law enforcement personnel in each of the site areas. CSSM staff notified other appropriate city/county and Department of Transportation personnel. The purpose was to ensure that the appropriate officials in each site area would be aware of the project and the days and times that Data Collectors would be at work in their area.

Data Collection Staff Training

Iowa utilized five primary data collectors in 2021, responsible for 7 to 20 sites each. All data collectors were experienced, having worked as data collectors for the project in the past. Quality Control functions were filled by three individuals: The Project Manager, one experienced data collector, and one staff member new to the project.

Training for 2021 was held at CSSM on one day, June 8, 2021, with field data collection beginning on June 9, 2021. Similar to 2020's training, the training occurred in a large room with physical distancing at all times. Trainers and Data Collectors were encouraged to wear masks/face coverings. The training included a combination of lecture, classroom and field exercises.   Training sessions covered data collection protocols, including how to find the observation sites, choosing an observation location, how to properly collect data, practice in what counts as seat belt "use," "nonuse," and "use unknown," what to do if data cannot be collected at a site due to road construction, weather, or other circumstances, and the appropriate

management and submission of collected data. Roadside safety training was provided in person by David Veneziano, Safety Circuit Rider at Iowa State University's Institute for Transportation (*InTrans*). The 2021 training agenda is shown in Figure 1.

The new quality control monitor received some additional one-on-one training with the Project Manager to ensure that they were comfortable with project procedures and observation site identification.

The QC Monitors reviewed the specific duties of the position. Quality Control duties included conducting unannounced site visits to a minimum of two sites for each Data Collector (12% of the total sites) and reviewing the Data Collector's field protocol. The QC Monitors met with the Data Collectors in the field to answer questions and offer assistance as needed.

Data Collectors were provided with bright yellow high-vis vests and hats to wear for safety and protection from sun and light rain. Each Data Collector had a flashing amber light to put on his/her car and a clicker-counter and stop watch to use as needed. Each Data Collector was also provided with two "Survey Crew" signs and sandbag weights for use in high speed areas and other sites as appropriate.

Observation Protocols and Procedures

All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation. Data Collectors completed two forms in the field, the Observation Site Form and the Observation Tally Form, which are shown in Appendixes A and B. The Observation Site Form documented descriptive information about each site. Data Collectors recorded information including observation date, site location and number, alternative site data, traffic directions and lanes available and observed, start and end times for observations, and weather conditions.

The Observation Tally Form was used to mark belt use/non-use/unknown use for drivers and right front passengers. Using the Observation Tally Form, seat belt use observations were made of all passenger vehicle drivers and right front seat occupants in the selected lane. The only passenger vehicle right front seat occupants excluded from the study were child passengers traveling in child seats with harness straps. If there was no passenger in the right front seat of an observed vehicle, that information was also noted on the Observation Tally Form.

Seat Belt use categories - Data Collectors recorded belt use for the driver and right front seat passenger using the definitions shown in Figure 2 below, which were provided in the federal regulations.

Figure 2.

Code	Meaning	Definition
Y	Yes, belted	The shoulder belt is in front of the person's shoulder.
N	No, unbelted	The shoulder belt is not in front of the person's shoulder.
U	Unknown	It cannot reasonably be determined whether the driver or right front passenger is belted.
NP	No passenger	There is no right front passenger present.

Scheduling.

Data collectors were generally assigned one county with five observation sites per work day. The 14 Polk County sites were divided among three Data Collectors. A schedule of sites with observation start times was provided by CSSM in order to ensure a representative sampling of times of day for the data collection and to allow for proper notification of county/city and law enforcement personnel. Observations were to start at the assigned times, as much as possible, and to continue for exactly 45 minutes each.

Observations.

Data Collectors observed one lane and one direction of travel per observation site. The direction of travel was randomly assigned by the office; however, Data Collectors were allowed to observe the other direction if safety or windshield glare dictated. Deviations from the randomly assigned direction were noted on the Observation Site Form. If an assigned road segment included an intersection, Data Collectors were instructed to observe traffic traveling on the assigned road segment, not the cross-street.

Lower volume roadways such as county roads and streets were observed from a field drive or other location where data collectors could safely move their vehicles from the roadway. In some cases Data Collectors observed from their vehicle while, in most cases, observing from outside of the vehicle was more effective. At times Data Collectors found that sitting in the back of their pick-up truck, van, or SUV provided the safest observation point with the best view.

Whenever possible, observations for high-volume, limited access roadways were made from an overpass. Observing from an overpass allowed for comparatively easy viewing of seatbelt use for both the driver and the passenger. Gravel road overpasses were preferred because of the low traffic volume, reducing safety hazards to the Data Collector. In some instances, observing from an overpass required moving the observation point from the specific road segment by a few miles; however, because of the limited exit and entrance ramps to these roadways, there were no significant changes to the observed vehicles between the assigned road segment and the observation point.

If a low volume overpass was not available, Data Collectors were allowed to observe traffic at an exit ramp or rest stop. Because the exit ramp/rest stop only sampled a portion of the traffic passing on the main highway, an additional traffic volume count was required in order to adjust for the reduced numbers. Data collectors completed a traffic count of the assigned highway segment immediately following the observations at the ramp/rest stop. From a safe observation point from which to view passing cars (but not necessarily belt usage), the data collector counted passing cars in one direction and in one lane of the assigned road segment, timing the number of minutes to reach a count of 100 cars. If the traffic volume was low, the count continued for 15 minutes, at which point the data collector recorded the number of cars observed in a 15-minute time frame. This traffic count information was recorded on the Observation Site Form and was used to adjust the seat belt usage observation data when observations were made away from the selected road segment at a rest stop or exit ramp. Five rest stop sites were used in 2021.

Alternate Sites.

If unexpected construction or difficulty in locating a useable and safe place to observe required the Data collector to deviate farther than 2 miles (or more than one block in city situations) from the selected road segment, he/she was instructed to call the office before proceeding and to note the location as an alternate site on the Observation Site form. For the 2021 data collection no new sites were needed.

Rescheduling.

If an assigned road segment was temporarily unavailable due to a traffic accident or inclement weather, data collection was to be rescheduled another week for the same time and day of the week. No sites needed to be rescheduled in 2021.

Results

Data collection for 2021 occurred from Wed, June 9 through Sat, June 19, 2021. The 2021 seat belt use data collection resulted in the observation of **12,938 passenger vehicles**, with a right front seat passenger in 4,719 of those vehicles, for a total of **17,657 potential observations** of belt use. Of these 17,657 potential observations, there were 12,205 drivers and 4,357 right front passengers who were observed to be wearing seat belts (total 16,562 seat belt users). Seat belts were not worn by 616 drivers and 317 right front passengers (total 933 unbelted). Data collectors were unable to observe the seat belt use of 129 drivers and 47 passengers (total 176 unknown use). The **unknown use, or "nonresponse rate," is .0099 or .99%**. This is well within the range allowed by federal regulations, which require the nonresponse rate to be below 10%.

The number of observations in 2021 is 3,498 fewer than in 2020; the number of vehicles observed decreased by 2,750 and the number of passengers decreased by 748. The number of observations varies from year to year in part because sites are intentionally observed on different days of the week and times of day as much as is practical. 2020 saw the team observing for 60 minutes due to the possibility of seeing fewer vehicles on the roads due to the pandemic, while in 2021 they observed each site for 45 minutes as was the norm before 2020. Federal regulations require a minimum of 7500 observations, and the 2021 total of 12,938 passenger vehicles with 17,657 observed occupants far exceeds the minimum requirement.

Ten quality control checks were completed in 2021. Each of the five primary data collectors was observed by a quality control monitor at two unannounced sites to ensure compliance with project protocols. This comprises 12% of the sites (10 out of 84), which exceeds the minimum of 5% required by federal regulations. No problems were identified through these quality control checks

Federal regulations require the calculation of seat belt use to be conducted with weighted data as described in the approved survey plan. Data weighting was completed by Dr. Emily Berg, Assistant Professor of Statistics at Iowa State University. Based on the weighted data, **Iowa's overall seat belt use rate for 2021 is 92.8%**, with an **estimated standard error of .9% (± 1%)**. Weighted seat belt use rates since 2012 are shown in Figure 3.

Figure 3. Iowa's Annual Weighted Seat Belt Use Rate, 2012-2020.

Year	Weighted Belt Use
2021	92.8%
2020	95.2%
2019	94.6%
2018	93.9%
2017	91.4%
2016	93.8%

2015	93.0%
2014	92.8%
2013	91.9%
2012	92.4%

Tables and Appendices

Table 1 lists the 84 observation sites with selected characteristics and the number of belted drivers and right front passengers.

Tables 2 and 3 show the seat belt use of drivers and passengers by county. Table 2 contains the number or count of each category of belt use by drivers, passengers, and total for each sampled county. Table 3 contains two types of unweighted percentages of belt use for drivers, passengers, and combined total for each county. The "% of Total Belted" is the percent of the total number of persons (both drivers and passengers) who were belted. The "% of Known Belted" removes the persons with unknown belt use from the base number, so it becomes the percent of persons with known seat belt status who were belted. Note that these percentages are unweighted and the state-wide seat belt use percentage is slightly different than the weighted seat belt use percentage required by federal regulations for reporting. Nevertheless the unweighted percentages in Table 3 enable legitimate comparisons between seat belt users/nonusers and between counties.

Tables 4 and 5 show the seat belt use of drivers and passengers by road type. Table 4 contains the number in each category and Table 5 contains unweighted percentages. Federal regulations required the new survey plan to classify road types as primary (including interstates), secondary, and local.

Table 6 contains seat belt use of drivers and passengers by day of the week and road type. The percentages included in the table are unweighted.

Table 7 contains sample weights for each observation site as well as seat belt use for drivers and passengers (number or count). This information is used for Part B reporting purposes.

Appendix A. Observation Site Form
Appendix B. Observation Tally Form
Appendix C: Weighting

Table 1. 2021 Seat Belt Usage

No.	County	MSLINK	Road name	Road Type	Day	Start Time	Vehicle Count	Drivers Belted	Right Front Passenger Count	Right Front Passengers Belted
1	Allamakee	4235	IOWA 76	Secondary	Friday	11:34 AM	26	25	4	4
2	Allamakee	3960	CO X20/LYCURGUS RD	Secondary	Friday	12:47 PM	75	59	20	17
3	Allamakee	3913	HIGHWAY 9/76	Secondary	Friday	2:28 PM	125	107	41	39
4	Allamakee	4521	FOREST MILLS RD	Secondary	Friday	3:26 PM	16	15	6	6
5	Allamakee	4246	HWY 364/X52	Secondary	Friday	4:44 PM	40	34	20	20
1	Black Hawk	19383	W AIRLINE HWY	Local	Thursday	11:05 AM	55	47	17	14
2	Black Hawk	20322	LAFAYETTE ST	Local	Thursday	12:05 PM	37	32	10	5
3	Black Hawk	14933	US 20	Secondary	Thursday	1:45 PM	494	481	109	91
4	Black Hawk	14762	I 380	Primary	Thursday	3:15 PM	209	204	91	80
5	Black Hawk	15023	HUDSON RD	Secondary	Thursday	4:40 PM	149	140	59	55
1	Cerro Gordo	46024	190TH ST	Secondary	Thursday	10:53 AM	6	5	0	0
2	Cerro Gordo	45722	S FEDERAL AVE	Secondary	Thursday	12:10 PM	132	119	35	26
3	Cerro Gordo	47140	1ST ST NW	Local	Thursday	1:55 PM	148	119	43	31
4	Cerro Gordo	45427	I 35	Primary	Thursday	3:18 PM	207	198	89	76
5	Cerro Gordo	45409	I 35	Primary	Thursday	5:05 PM	168	151	62	58
1	Clayton	57598	US 18	Secondary	Saturday	7:37 AM	45	43	15	14
2	Clayton	57848	IOWA 13	Secondary	Saturday	8:51 AM	126	120	72	70
3	Clayton	57842	IOWA 13	Secondary	Saturday	9:51 AM	181	173	115	113
4	Clayton	332445	GREAT RIVER RD	Secondary	Saturday	11:05 AM	17	15	9	9
5	Clayton	57789	IOWA 13/Elkader St	Secondary	Saturday	12:22 PM	71	67	40	40
1	Franklin	97664	I 35	Primary	Friday	9:20 AM	215	214	109	100
2	Franklin	97666	I 35	Primary	Friday	10:40 AM	272	266	157	145
3	Franklin	97686	I 35	Primary	Friday	12:00 PM	265	260	120	108
4	Franklin	97753	US 65	Secondary	Friday	1:50 PM	69	60	19	15
5	Franklin	97955	VINE AVE	Secondary	Friday	3:10 PM	7	7	9	9
1	Harrison	331806	I 29	Primary	Monday	10:30 AM	17	16	7	6
2	Harrison	116865	I 29	Primary	Monday	11:50 AM	201	197	110	103
3	Harrison	116946	I 29	Primary	Monday	1:45 PM	220	210	124	119
4	Harrison	118343	LOCUST ST	Secondary	Monday	3:05 PM	18	16	0	0
5	Harrison	117168	IOWA 44	Secondary	Monday	4:30 PM	25	24	3	3
1	Jefferson	138811	PACKWOOD RD	Secondary	Friday	9:55 AM	20	18	6	6
2	Jefferson	138218	IOWA 1	Secondary	Friday	11:03 AM	33	29	8	7
3	Jefferson	139125	W STONE AVE	Local	Friday	12:52 PM	33	26	7	6
4	Jefferson	138095	W BURLINGTON AVE	Secondary	Friday	1:50 PM	258	226	69	61
5	Jefferson	323114	US 34	Secondary	Friday	3:05 PM	160	153	59	57
1	Johnson	140987	US 218	Secondary	Thursday	10:10 AM	266	258	116	113
2	Johnson	141286	OAK CREST HILL RD NE	Secondary	Thursday	11:20 AM	141	135	34	31
3	Johnson	333258	I 380	Primary	Thursday	1:10 PM	452	437	150	144
4	Johnson	140631	I 80	Primary	Thursday	2:40 PM	415	397	105	102
5	Johnson	143520	S MADISON ST	Local	Thursday	4:00 PM	71	70	16	14
1	Linn	159181	IOWA 13	Secondary	Tuesday	11:50 AM	128	120	40	40
2	Linn	159157	IOWA 13	Secondary	Tuesday	12:55 PM	147	140	39	36
3	Linn	163355	NORMANDY DR NE	Local	Tuesday	2:37 PM	5	5	0	0

No.	County	MSLINK	Road name	Road Type	Day	Start Time	Vehicle Count	Drivers Belted	Right Front Passenger Count	Right Front Passengers Belted
4	Linn	341551	I 380	Primary	Tuesday	3:55 PM	427	415	98	94
5	Linn	160653	WRIGHT BROS BLVD SW	Local	Tuesday	5:25 PM	127	117	36	34
1	Marshall	183837	ZELLER AVE	Secondary	Wednesday	8:40 AM	39	33	12	8
2	Marshall	185108	E STATE ST	Local	Wednesday	9:45 AM	37	32	10	9
3	Marshall	183738	S CENTER ST	Secondary	Wednesday	10:45 AM	159	145	31	28
4	Marshall	183538	240TH ST	Secondary	Wednesday	12:35 PM	171	160	45	41
5	Marshall	336356	240TH ST	Secondary	Wednesday	1:55 PM	112	102	31	28
1	Polk	218613	NE 126TH AVE	Secondary	Wednesday	9:56 AM	61	56	4	3
2	Polk	215189	I 35	Primary	Wednesday	9:25 AM	26	23	5	5
3	Polk	319250	I 35	Primary	Wednesday	11:05 AM	388	371	75	64
4	Polk	216270	NE 14TH ST	Secondary	Monday	11:48 AM	227	207	30	26
5	Polk	223763	6TH AVE	Local	Wednesday	11:03 AM	207	181	43	35
6	Polk	220551	E HARTFORD AVE	Local	Monday	12:52 PM	95	85	6	5
7	Polk	216087	NE 14TH ST	Secondary	Sunday	7:39 AM	134	133	32	30
8	Polk	216414	E ARMY POST RD	Local	Sunday	8:37 AM	152	137	50	47
9	Polk	220874	GREENWOOD DR	Local	Sunday	9:50 AM	3	2	2	2
10	Polk	222431	58TH ST	Local	Sunday	10:54 AM	6	6	1	1
11	Polk	318107	I 35	Primary	Sunday	12:02 PM	527	513	262	257
12	Polk	214995	I 35	Primary	Sunday	9:11 AM	409	403	193	191
13	Polk	215450	I 35	Primary	Sunday	8:09 AM	369	357	47	44
14	Polk	317252	IOWA 141	Secondary	Sunday	7:00 AM	89	85	13	12
1	Pottawattamie	229510	HWY 680	Primary	Tuesday	8:00 AM	4	4	2	1
2	Pottawattamie	229263	I 80	Primary	Tuesday	9:40 AM	278	273	139	135
3	Pottawattamie	229243	I 80	Primary	Tuesday	11:00 AM	22	22	12	11
4	Pottawattamie	230312	RAILROAD HWY	Secondary	Tuesday	12:30 PM	64	63	19	18
5	Pottawattamie	233270	S 1ST ST	Local	Tuesday	2:15 PM	195	181	59	55
1	Scott	242997	I 80	Primary	Monday	11:25 AM	284	267	84	81
2	Scott	243110	I 80	Primary	Monday	12:50 PM	20	20	13	12
3	Scott	245937	W LOCUST ST	Local	Monday	2:50 PM	257	230	66	58
4	Scott	246372	E 42ND ST	Local	Monday	3:50 PM	90	87	21	19
5	Scott	243558	US 61	Secondary	Monday	5:25 PM	239	224	81	73
1	Woodbury	294873	FLORENCE AVE	Local	Saturday	11:00 AM	49	34	22	16
2	Woodbury	296162	FAIRMOUNT ST	Local	Saturday	12:15 PM	128	121	30	27
3	Woodbury	292360	GORDON DR	Secondary	Saturday	2:00 PM	265	238	129	115
4	Woodbury	292173	SINGING HILLS BLVD	Secondary	Saturday	3:10 PM	214	199	115	106
5	Woodbury	317734	I 29	Primary	Saturday	4:15 PM	497	490	309	292
1	Worth	298621	THRUSH AVE	Secondary	Friday	7:30 AM	46	39	3	1
2	Worth	298440	I 35	Primary	Friday	9:20 AM	232	219	124	114
3	Worth	298465	I 35	Primary	Friday	10:35 AM	225	214	127	110
4	Worth	298467	I 35	Primary	Friday	11:50 AM	285	268	172	154
5	Worth	299696	MALLARD AVE	Secondary	Friday	1:00 PM	14	11	2	2
							12938	12205	4719	4357

Table 2. 2021 Driver and Passenger Seat Belt Use by County (n)

County	Drivers				Right Front Passengers				TOTAL			
	Total	Belted	Not Belted	Unknown	Total	Belted	Not Belted	Unknown	Total	Belted	Not Belted	Unknown
Allamakee	282	240	29	13	91	86	5	0	373	326	34	13
Black Hawk	944	904	39	1	286	245	39	2	1230	1149	78	3
Cerro Gordo	661	592	65	4	229	191	35	3	890	783	100	7
Clayton	440	418	14	8	251	246	2	3	691	664	16	11
Franklin	828	807	17	4	414	377	33	4	1242	1184	50	8
Harrison	481	463	18	0	244	231	12	1	725	694	30	1
Jefferson	504	452	44	8	149	137	8	4	653	589	52	12
Johnson	1345	1297	25	23	421	404	15	4	1766	1701	40	27
Linn	834	797	26	12	213	204	7	2	1047	1001	33	14
Marshall	518	472	44	2	129	114	15	0	647	586	59	2
Polk	2693	2559	105	40	763	722	29	17	3456	3281	134	57
Pottawattamie	563	543	20	0	231	220	11	0	794	763	31	0
Scott	890	828	50	12	265	243	16	1	1155	1071	66	13
Woodbury	1153	1082	71	0	605	556	49	0	1758	1638	120	0
Worth	802	751	49	2	428	381	41	6	1230	1132	90	8
Total	**12938**	**12205**	**616**	**129**	**4719**	**4357**	**317**	**47**	**17657**	**16562**	**933**	**176**

Table 3. 2021 Driver and Passenger Seat Belt Use by County (unweighted percentages)

County	Drivers		Right Front Passengers		TOTAL	
	% of Total Belted	% of Known Belted	% of Total Belted	% of Known Belted	% of Total Belted	% of Known Belted
Allamakee	85.1%	89.2%	94.5%	94.5%	87.4%	90.6%
Black Hawk	95.8%	95.9%	85.7%	86.3%	93.4%	93.6%
Cerro Gordo	89.6%	90.1%	83.4%	84.5%	88.0%	88.7%
Clayton	95.0%	96.8%	98.0%	99.2%	96.1%	97.6%
Franklin	97.5%	97.9%	91.1%	92.0%	95.3%	95.9%
Harrison	96.3%	96.3%	94.7%	95.1%	95.7%	95.9%
Jefferson	89.7%	91.1%	91.9%	94.5%	90.2%	91.9%
Johnson	96.4%	98.1%	96.0%	96.9%	96.3%	97.8%
Linn	95.6%	97.0%	95.8%	96.7%	95.6%	96.9%
Marshall	91.1%	91.5%	88.4%	88.4%	90.6%	90.9%
Polk	95.0%	96.5%	94.6%	96.8%	94.9%	96.5%
Pottawattamie	96.4%	96.4%	95.2%	95.2%	96.1%	96.1%
Scott	93.0%	94.3%	91.7%	92.0%	92.7%	93.8%
Woodbury	93.8%	93.8%	91.9%	91.9%	93.2%	93.2%
Worth	93.6%	93.9%	89.0%	90.3%	92.0%	92.6%
Total	**94.3%**	**95.3%**	**92.3%**	**93.3%**	**93.8%**	**94.7%**

Table 4. 2021 Seat Belt Use by Road Type (n)

Road Type	Drivers				Right Front Passengers				Total			
	Total	Belted	Not Belted	Un-known	Total	Belted	Not Belted	Un-known	Total	Belted	Not Belted	Un-known
Local	1695	1512	166	17	439	378	52	9	2134	1890	218	26
Primary	6634	6409	169	57	2786	2606	163	24	9420	9015	332	81
Secondary	4609	4284	281	55	1494	1373	102	14	6103	5657	383	69
TOTAL	**12938**	**12205**	**616**	**129**	**4719**	**4357**	**317**	**47**	**17657**	**16562**	**933**	**176**

Table 5. 2021 Seat Belt Use by Road Type (unweighted percentages)

Road Type	Drivers		Right Front Passengers		Total	
	% of Total Belted	% of Known Belted	% of Total Belted	% of Known Belted	% of Total Belted	% of Known Belted
Local	89.2%	90.1%	86.1%	87.9%	88.6%	89.7%
Primary	96.6%	97.4%	93.5%	94.4%	95.7%	96.5%
Secondary	92.9%	94.1%	91.9%	92.8%	92.7%	93.8%
TOTAL	**94.3%**	**95.3%**	**92.3%**	**93.3%**	**93.8%**	**94.7%**

Table 6. 2021 Driver and Passenger Seat Belt Use by Day of Week and Road Type (n & unweighted %)

	Drivers Belted	Total Drivers	Passengers Belted	Total Passengers	% Drivers Belted	% Passengers Belted
Sunday	**1312**	**1377**	**452**	**474**	**95.28%**	**95.36%**
Local	145	161	50	53	90.06%	94.34%
Primary	907	941	326	342	96.39%	95.32%
Secondary	260	275	76	79	94.55%	96.20%
Monday	**1809**	**1912**	**620**	**657**	**94.61%**	**94.37%**
Local	402	442	82	93	90.95%	88.17%
Primary	1257	1305	474	496	96.32%	95.56%
Secondary	150	165	64	68	90.91%	94.12%
Tuesday	**1580**	**1647**	**648**	**689**	**95.93%**	**94.05%**
Local	303	327	89	95	92.66%	93.68%
Primary	996	1033	499	530	96.42%	94.15%
Secondary	281	287	60	64	97.91%	93.75%
Wednesday	**1406**	**1532**	**605**	**682**	**91.78%**	**88.71%**
Local	213	244	44	53	87.30%	83.02%
Primary	482	510	264	299	94.51%	88.29%
Secondary	711	778	297	330	91.39%	90.00%
Thursday	**2030**	**2162**	**580**	**632**	**93.89%**	**91.77%**
Local	268	311	64	86	86.17%	74.42%
Primary	1059	1082	382	393	97.87%	97.20%
Secondary	703	769	134	153	91.42%	87.58%
Friday	**2655**	**2801**	**1037**	**1140**	**94.79%**	**90.96%**
Local	26	33	6	7	78.79%	85.71%
Primary	1293	1336	567	628	96.78%	90.29%
Secondary	1336	1432	464	505	93.30%	91.88%
Saturday	**1413**	**1507**	**415**	**445**	**93.76%**	**93.26%**
Local	155	177	43	52	87.57%	82.69%
Primary	415	427	94	98	97.19%	95.92%
Secondary	843	903	278	295	93.36%	94.24%
Total	**12205**	**12938**	**4357**	**4719**	**94.33%**	**92.33%**

Table 7. Sample Weights and Seat Belt Use by Observation Site: Part B Reporting Data (n)

Site ID	Site Type	Date Observed	Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants Unknown Belt Use
201	Original	6/18/2021	2330.68	26	4	29	1	0
202	Original	6/18/2021	8343.15	75	20	76	13	6
203	Original	6/18/2021	3423.12	125	41	146	15	5
204	Original	6/18/2021	3423.12	16	6	21	1	0
205	Original	6/18/2021	8343.15	40	20	54	4	2
206	Original	6/10/2021	307.13	55	17	61	9	2
207	Original	6/10/2021	4732.97	37	10	37	10	0
208	Original	6/10/2021	33.41	494	109	572	31	0
209	Original	6/10/2021	34.02	209	91	284	15	1
210	Original	6/10/2021	547.53	149	59	195	13	0
211	Original	6/10/2021	2990.25	6	0	5	1	0
212	Original	6/10/2021	263.27	132	35	145	19	3
213	Original	6/10/2021	8379.34	148	43	150	41	0
214	Original	6/10/2021	45.81	207	89	274	19	3
215	Original	6/10/2021	46.15	168	62	209	20	1
216	Original	6/19/2021	1650.21	45	15	57	1	2
217	Original	6/19/2021	1007.35	126	72	190	5	3
218	Original	6/19/2021	697.67	181	115	286	5	5
219	Original	6/19/2021	3822.40	17	9	24	2	0
220	Original	6/19/2021	715.92	71	40	107	3	1
221	Original	6/18/2021	77.27	215	109	314	9	1
222	Original	6/18/2021	57.98	272	157	411	15	3
223	Original	6/18/2021	60.93	265	120	368	14	3
224	Original	6/18/2021	394.09	69	19	75	12	1
225	Original	6/18/2021	6893.71	7	9	16	0	0
226	Original	6/14/2021	275.10	17	7	22	2	0
227	Original	6/14/2021	510.90	201	110	300	11	0
228	Original	6/14/2021	46.89	220	124	329	14	1
229	Original	6/14/2021	19412.44	18	0	16	2	0
230	Original	6/14/2021	2050.40	25	3	27	1	0
231	Original	6/11/2021	768.51	20	6	24	2	0
232	Original	6/11/2021	781.49	33	8	36	3	2
233	Original	6/11/2021	1946.22	33	7	32	7	1
234	Original	6/11/2021	1014.59	258	69	287	35	5
235	Original	6/11/2021	144.92	160	59	210	5	4
236	Original	6/17/2021	47.35	266	116	371	7	4
237	Original	6/17/2021	2339.39	141	34	166	6	3
238	Original	6/17/2021	62.27	452	150	581	12	9
239	Original	6/17/2021	217.27	415	105	499	12	11
240	Original	6/17/2021	1473.39	71	16	84	3	0
241	Original	6/15/2021	352.56	128	40	160	5	3
242	Original	6/15/2021	292.44	147	39	176	7	3
243	Original	6/15/2021	3411.28	5	0	5	0	0

Site ID	Site Type	Date Observed	Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants Unknown Belt Use
244	Original	6/15/2021	185.60	427	98	509	13	4
245	Original	6/15/2021	391.09	127	36	151	8	4
246	Original	6/16/2021	1223.51	39	12	41	10	0
247	Original	6/16/2021	2265.63	37	10	41	6	0
248	Original	6/16/2021	1101.32	159	31	173	17	0
249	Original	6/16/2021	395.13	171	45	201	13	2
250	Original	6/16/2021	166.31	112	31	130	13	0
251	Original	6/9/2021	4252.12	61	4	59	5	1
252	Original	6/9/2021	23.19	26	5	28	3	0
253	Original	6/9/2021	94.06	388	75	435	24	4
254	Original	6/14/2021	2014.13	227	30	233	19	5
255	Original	6/9/2021	118.61	207	43	216	22	12
256	Original	6/14/2021	309.42	95	6	90	10	1
257	Original	6/13/2021	965.18	134	32	163	10	4
258	Original	6/13/2021	1121.58	152	50	184	14	4
259	Original	6/13/2021	3940.02	3	2	4	1	0
260	Original	6/13/2021	3037.10	6	1	7	0	0
261	Original	6/13/2021	164.94	527	262	770	3	20
262	Original	6/13/2021	97.69	409	193	594	6	3
263	Original	6/13/2021	148.24	369	47	401	13	2
264	Original	6/13/2021	533.84	89	13	97	4	1
265	Original	6/15/2021	437.53	4	2	5	1	0
266	Original	6/15/2021	141.92	278	139	408	9	0
267	Original	6/15/2021	485.35	22	12	33	1	0
268	Original	6/15/2021	1212.31	64	19	81	2	0
269	Original	6/15/2021	200.35	195	59	236	18	0
270	Original	6/14/2021	28.17	284	84	348	12	8
271	Original	6/14/2021	241.30	20	13	32	1	0
272	Original	6/14/2021	149.50	257	66	288	33	2
273	Original	6/14/2021	4563.27	90	21	106	5	0
274	Original	6/14/2021	79.69	239	81	297	15	3
275	Original	6/12/2021	3041.10	49	22	50	21	0
276	Original	6/12/2021	1403.80	128	30	148	10	0
277	Original	6/12/2021	1305.55	265	129	353	41	0
278	Original	6/12/2021	439.23	214	115	305	24	0
279	Original	6/12/2021	311.79	497	309	782	24	0
280	Original	6/11/2021	996.36	46	3	40	8	1
281	Original	6/11/2021	235.00	232	124	333	22	1
282	Original	6/11/2021	103.50	225	127	324	26	2
283	Original	6/11/2021	114.38	285	172	422	31	4
284	Original	6/11/2021	3718.53	14	2	13	3	0
			TOTALS	12938	4719	16562	933	176

Appendix A. Observation Site Form 2021

Iowa Seat Belt Survey
Observation Site Form

Data Collector ID# _____   Date: _____ / _____ /2021

Site Identification:

ID: _____   County : _____

Road Name: _____   Co Site #: _____

Site Start and End Time:

Start time for observations: _____am/pm

End time for observations: _____am/pm

(Total observation period MUST last exactly 45 minutes)

Site Description:

Selected traffic flow direction: North   South   East   West

Total number of lanes in selected direction: _____

Weather Conditions: Clear   Cloudy/PC   Light Fog   Light Rain

Alternate Site Information:

Is this an alternate site (not including a
recommended observation point)?   No   Yes

If yes, why was an alternate site needed?

_____

Traffic Count:

Is a traffic count required
(exit ramp or rest stop)?   No   Yes

If yes,
Number of Cars: _____   Duration: _____

Appendix B. Observation Tally Form 2021

Iowa Seat Belt Survey – Observation Form

County: _____   Page ___ of ___

County site #: _____

ID #: _____   Data Collector ID# _____

Responses: Y = Yes, N = No, U = Unknown, NP = No Passenger

VEHICLE NUMBER	DRIVER SEATBELT USE			PASSENGER SEATBELT USE				VEHICLE NUMBER	DRIVER SEATBELT USE			PASSENGER SEATBELT USE			
1	Y	N	U	Y	N	U	NP	41	Y	N	U	Y	N	U	NP
2	Y	N	U	Y	N	U	NP	42	Y	N	U	Y	N	U	NP
3	Y	N	U	Y	N	U	NP	43	Y	N	U	Y	N	U	NP
4	Y	N	U	Y	N	U	NP	44	Y	N	U	Y	N	U	NP
5	Y	N	U	Y	N	U	NP	45	Y	N	U	Y	N	U	NP
6	Y	N	U	Y	N	U	NP	46	Y	N	U	Y	N	U	NP
7	Y	N	U	Y	N	U	NP	47	Y	N	U	Y	N	U	NP
8	Y	N	U	Y	N	U	NP	48	Y	N	U	Y	N	U	NP
9	Y	N	U	Y	N	U	NP	49	Y	N	U	Y	N	U	NP
10	Y	N	U	Y	N	U	NP	50	Y	N	U	Y	N	U	NP
11	Y	N	U	Y	N	U	NP	51	Y	N	U	Y	N	U	NP
12	Y	N	U	Y	N	U	NP	52	Y	N	U	Y	N	U	NP
13	Y	N	U	Y	N	U	NP	53	Y	N	U	Y	N	U	NP
14	Y	N	U	Y	N	U	NP	54	Y	N	U	Y	N	U	NP
15	Y	N	U	Y	N	U	NP	55	Y	N	U	Y	N	U	NP
16	Y	N	U	Y	N	U	NP	56	Y	N	U	Y	N	U	NP
17	Y	N	U	Y	N	U	NP	57	Y	N	U	Y	N	U	NP
18	Y	N	U	Y	N	U	NP	58	Y	N	U	Y	N	U	NP
19	Y	N	U	Y	N	U	NP	59	Y	N	U	Y	N	U	NP
20	Y	N	U	Y	N	U	NP	60	Y	N	U	Y	N	U	NP
21	Y	N	U	Y	N	U	NP	61	Y	N	U	Y	N	U	NP
22	Y	N	U	Y	N	U	NP	62	Y	N	U	Y	N	U	NP
23	Y	N	U	Y	N	U	NP	63	Y	N	U	Y	N	U	NP
24	Y	N	U	Y	N	U	NP	64	Y	N	U	Y	N	U	NP
25	Y	N	U	Y	N	U	NP	65	Y	N	U	Y	N	U	NP
26	Y	N	U	Y	N	U	NP	66	Y	N	U	Y	N	U	NP
27	Y	N	U	Y	N	U	NP	67	Y	N	U	Y	N	U	NP
28	Y	N	U	Y	N	U	NP	68	Y	N	U	Y	N	U	NP
29	Y	N	U	Y	N	U	NP	69	Y	N	U	Y	N	U	NP
30	Y	N	U	Y	N	U	NP	70	Y	N	U	Y	N	U	NP
31	Y	N	U	Y	N	U	NP	71	Y	N	U	Y	N	U	NP
32	Y	N	U	Y	N	U	NP	72	Y	N	U	Y	N	U	NP
33	Y	N	U	Y	N	U	NP	73	Y	N	U	Y	N	U	NP
34	Y	N	U	Y	N	U	NP	74	Y	N	U	Y	N	U	NP
35	Y	N	U	Y	N	U	NP	75	Y	N	U	Y	N	U	NP
36	Y	N	U	Y	N	U	NP	76	Y	N	U	Y	N	U	NP
37	Y	N	U	Y	N	U	NP	77	Y	N	U	Y	N	U	NP
38	Y	N	U	Y	N	U	NP	78	Y	N	U	Y	N	U	NP
39	Y	N	U	Y	N	U	NP	79	Y	N	U	Y	N	U	NP
40	Y	N	U	Y	N	U	NP	80	Y	N	U	Y	N	U	NP

The design is a 2-stage design with stratification and PPSWOR sampling used at both stages. Let h and ℓ denote the strata for the first and second stages, respectively. Let i index the PSU, and j index the SSU. Let $w_{hi\ell j}$ be the inverse of the probability of selecting PSU i and SSU j.

The same sampling units have been visited for three years. The estimates and standard errors for the first two years have already been published. The task is to construct estimates and standard errors for the third year. In Section 1, we discuss estimation. In Section 2, we discuss variance estimation.

1   Estimators

The number of observations measured on each element $(hi\ell j)$ is $m_{hi\ell j}$. The response variable is binary, and the proportion for each element $(hi\ell j)$ is

$$p_{hi\ell j} = \frac{1}{m_{hi\ell j}} \sum_{t=1}^{m_{hi\ell j}} y_{hi\ell jt}. \tag{1}$$

Denote the known size of each SSU by $\nu_{hi\ell j}$. The estimator of the population proportion is defined

$$\hat{p} = \frac{\sum_{hi\ell j} w_{hi\ell j} \nu_{hi\ell j} p_{hi\ell j}}{\sum_{hi\ell j} w_{hi\ell j} \nu_{hi\ell j}}. \tag{2}$$

2   Variance Estimators

The standard errors for the first two years are obtained from a jackknife procedure. The method used previously (old method) and a proposed method are defined below. The main difference between the "old method" and the proposed methods is that the old method deletes an SSU from each replicate, while the proposed method deletes PSUs.

For the "old method," 75 replicates are defined. The weight for element (h, i, ℓ, j) for replicate r $(r = 1, \ldots, 75)$ is

$$w_{hi\ell j}^{(r)} = \begin{cases} 0 & \text{if element } h, i, \ell, j \text{ is deleted} \\ \sqrt{(74)75^{-1}} w_{hi\ell j} & \text{otherwise.} \end{cases} \tag{3}$$

The jackknife variance estimator is then

$$\hat{V}_{J,1} = \sum_{r=1}^{75} (\hat{\theta}^{(r)} - \hat{p})^2, \tag{4}$$

where $\hat{\theta}^{(r)}$ is the estimate based on the rth set of replicate weights, and $\bar{\theta}$ is the average of the R replicate estimates.

We propose to use a jackknife variance estimator closely related to a method defined in Rao, Wu, and Yue (1992). This method defines n_h replicates for each stratum h, where n_h is the number of PSUs selected for stratum h. The replicate weight is defined

$$w_{h'i'\ell j} = \begin{cases} w_{hi\ell j} & \text{for } h \neq h', i \neq i' \\ n_{h'}(n_{h'} - 1)^{-1} w_{h'i\ell j} & \text{for } h = h', i \neq i' \\ 0 & \text{otherwise.} \end{cases} \tag{5}$$

The jackknife variance is then defined by

$$\hat{V}_{J,2} = \sum_{h=1}^{H} \frac{(n_h - 1)}{n_h} \sum_{i=1}^{n_h} (\hat{\theta}_{hi} - \hat{p})^2, \tag{6}$$

where $\hat{\theta}_{hi}$ is replicate estimate with the weight for PSU i set to 0, $\hat{\theta}_h$ is the average of the n_h replicate estimates for stratum h.